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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/668,869	09/22/2003	Richard D. Breault	C-2789	3166

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M. P. Williams
210 Main Street
Manchester, CT 06040

EXAMINER	
LEWIS, BEN	
ART UNIT	PAPER NUMBER
1745	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/07/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/668,869	BREAULT ET AL.	
	Examiner	Art Unit	
	Ben Lewis	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,6,7,9-14 and 16-21* is/are pending in the application.

4a) Of the above claim(s) *19 and 21* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *,3,6,7,9-14, 16-18 and 20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. The Applicant's amendment filed on December 18th, 2006 was received. Claims 1, 3, 6,7,12, 13, 14, 16 and 20 were amended. Claims 2,4-5, 8 and 15 were cancelled.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action (issued on July 17th, 2006).

Claim Rejections - 35 USC § 103

3. Claims 1,3,6-7,9-14, 16-18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koch et al (U.S. Pub No. 2003/014816A1) and further in view of Cisar et al. (U.S. Pub. No. 2003/0232234 A1).

With respect to claims 1 and 20, Koch et al disclose efficient fuel cell water transport plates wherein a fuel cell includes an anode, a cathode, and an electrolyte separating the two. Fuel reactant gas, typically a hydrogen rich stream, enters a support plate adjacent the anode (anode plate). Oxidant reactant gas, typically air, enters a support plate adjacent the cathode (cathode plate) (Paragraph 002). Due to their critical role in water management, the anode plates and cathode plates are often called "water transport plates" (WTP's). During PEM fuel cell operation the WTP's supply water locally to maintain humidification of the PEM, remove product water formed at the cathode, and supply water to the fuel cell to replenish water that has been

lost by evaporation. Furthermore, the water transport plates remove by-product heat via a circulating coolant water stream (coolant water); conduct electricity from cell to cell in stacks of cells of a fuel cell power plant; provide a gas separator between adjacent cells; and provide passages for conducting the reactants through the cells (Paragraph 0005).

Koch et al. also teach that, FIG. 2 is taken from U.S. Pat. No. 5,840,414, and provides background information indicating the importance of various properties of water transport plates. Briefly, the fuel cell stack as shown in FIG. 2 includes the polymer electrolyte membrane **20**, the porous cathode catalyst **22** and the porous anode catalyst **24** on the two sides of the membrane **20**. Hydrogen gas is supplied through the channels **26** of the upper separator plate **28**, and oxygen gas is supplied to the channels **30** of the lower separator plate **32**, with the channels **30** running perpendicular to the channels **26**. The hydrogen and oxygen combine, producing water and electricity. Coolant water flows through channel **36**. Additional membranes and separator plates are included in the stack, and the electrochemical reaction is taking place concurrently at various levels in the stack (Paragraph 0041).

Regarding the plates being porous and having water flow channels, Koch et al teach that typically, plates according to the present invention have a median pore size of 0.4 to 5.0 μm, with at least 50% pores by volume below 3.0 .μmM in size. Typically, the plate is stiff and provided with continuous flow channels on one or both faces of the plate (Paragraph 0064).

Koch et al also teach that referring more particularly to the drawings, FIG. 1 is a schematic showing of a fuel cell system. The system of FIG. 1 includes a source of hydrogen gas **12**, a source of oxygen **14**, which could be atmospheric air, and a fuel cell stack **16** which includes polymer electrolyte membranes (PEM) and separators, or water transport plates, as discussed below. The hydrogen and oxygen are combined, producing water as indicated by reference number **18**, and electricity as indicated at reference numeral 20 (Paragraph 0040).

Koch et al. does not specifically teach water transfer means disposed in each of said fuel cells for transferring water only internally within said stack from said cathode water transport plate to said anode transport plates. However, Cisar et al. disclose an electrochemical cell and bipolar assembly for an electrochemical cell wherein, the bipolar assembly of the present invention comprises a gas barrier and an array of electronically conducting and protruding posts engaged with the gas barrier (Paragraph 0041). Optionally, the gas barrier may provide the ability to transfer water between the cathode of one cell and the anode of an adjacent cell while maintaining isolation of the anode and cathode gases. The gas barrier that transfers water can be made from a water permeable material or a composite that includes a water permeable material. Suitable water permeable materials include, but are not limited to, silica, hydrophilic polymers, and cellulose (Paragraph 0045). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the water transfer means of Cisar et al. in to the fuel cell of Koch et al because Cisar et al teach that accordingly, water produced at the cathode, and normally rejected in the exhaust, passes through the barrier where it

humidifies the fuel being consumed. This is advantageous because it promotes the full humidification of the PEM membrane, which minimizes its resistance to proton flow (Paragraph 0016).

With respect to claim 2-8, Koch et al. teach that, FIG. 2 is taken from U.S. Pat. No. 5,840,414, and provides background information indicating the importance of various properties of water transport plates. Briefly, the fuel cell stack as shown in FIG. 2 includes the polymer electrolyte membrane **20**, the porous cathode catalyst **22** and the porous anode catalyst **24** on the two sides of the membrane **20**. Hydrogen gas is supplied through the channels **26** of the upper separator plate **28**, and oxygen gas is supplied to the channels **30** of the lower separator plate **32**, with the channels **30** running perpendicular to the channels **26**. The hydrogen and oxygen combine, producing water and electricity. Coolant water flows through channel **36** "manifold". Additional membranes and separator plates are included in the stack, and the electrochemical reaction is taking place concurrently at various levels in the stack (Paragraph 0041).

With respect to claim 9, Koch et al teach that referring more particularly to the drawings, FIG. 1 is a schematic showing of a fuel cell system. The system of FIG. 1 includes a source of hydrogen gas **12**, a source of oxygen **14**, which could be atmospheric air, and a fuel cell stack **16** which includes polymer electrolyte membranes (PEM) and separators, or water transport plates, as discussed below (Paragraph 0040).

With respect to claim 12, Cisar et al. discloses an electrochemical cell and bipolar assembly for an electrochemical cell wherein, the bipolar assembly of the present invention comprises a gas barrier and an array of electronically conducting and protruding posts engaged with the gas barrier (Paragraph 0041). Optionally, the gas barrier may provide the ability to transfer water between the cathode of one cell and the anode of an adjacent cell while maintaining isolation of the anode and cathode gases. The gas barrier that transfers water can be made from a water permeable material or a composite that includes a water permeable material. Suitable water permeable materials include, but are not limited to, silica, hydrophilic polymers, and cellulose (Paragraph 0045). The material used to make the gas barrier may also include fillers that promote strength, electronic conductivity, water permeability, or combinations thereof. These properties of the gas barrier may be provided by a single material or a composite. Optionally, the composite may include particles (such as fibers, powders, or pellets) that provide one or more of these properties. Particles suitable for enhancing electronic conductivity include, without limitation, ceramics, metals, alloys, graphite, or combinations thereof. Particles suitable for enhancing strength include, without limitation, silicon carbide, graphite, metals, and ceramics. Particles suitable for enhancing water permeability were set out above. Still other particles may be included to enhance other desirable properties of the composite, such as further reducing the weight, and making the composite hydrophobic or hydrophilic (Paragraph 0046).

With respect to claim 14 Cisar et al. teaches that in another embodiment, the gas barrier may be formed independently of the posts by casting the gas barrier around the array of posts. This may be accomplished, for example, by embedding the lower portion of the posts in a sacrificial material, creating a gas barrier layer on the top surface of the sacrificial material, curing or hardening the gas barrier layer, and, dissolving, or otherwise removing the sacrificial layer leaving the freestanding gas barrier secured to the posts (Paragraph 0014).

With respect to claim 15-16, Cisar et al. teach that optionally, the gas barrier may provide the ability to transfer water between the cathode of one cell and the anode of an adjacent cell while maintaining isolation of the anode and cathode gases. The gas barrier that transfers water can be made from a water permeable material or a composite that includes a water permeable material. Suitable water permeable materials include, but are not limited to, silica, hydrophilic polymers, and cellulose (Paragraph 0045). Cisar et al. also teach that the barrier may be solid, or porous, with the pores "holes" filled with a material that promotes the transfer of water from the cathode to the anode (Paragraph 0045).

With respect to claim 17, Cisar et al. teach that FIG. 1 is a cross sectional view of a bipolar assembly suitable for low-pressure operation in an electrochemical stack. The

gas barrier 14, which may be electronically conducting or non-conducting, separates the reactant fluids flowing across the face of the anode electrode 11 and the cathode electrode 12. A plurality of posts 15 is disposed across the gas barrier 14, each post being approximately perpendicular to the gas barrier. One end of each post contacts the current collector 13 on the anode electrode 11 and the other end of each post contacts the current collector 13 on the cathode electrode 12. The posts and the gas barrier form the "post-type" flow fields for the reactant fluids. One embodiment, as illustrated in FIG. 1, shows the posts 15 inserted through holes in the gas barrier 14, each post being sealed 16 into the hole in the gas barrier through which the post passes, thereby preventing reactant fluids from passing from one side of the gas barrier to the other (Paragraph 0051).

With respect to claims, 10-11, Koch et al as modified by Cisar et al. teach that examples of polymers that absorb or conduct moisture include perfluorosulfonic acids (such as Nafion), sulfonated polystyrene, sulfonated trifluorostyrene, polyacrylamides, and similar polymers (Paragraph 0016) (Cisar et al.). The instant specification recites that the hydrated nanoporous ionomer phase may consist of perflourosulfonic acid ionomer, to achieve a high water permeability PEM which is on the order of between 10 microns and 25 microns thick (Page 5 lines 15-28). Koch et al. as modified by Cisar et al. do not disclose water-filled phase data. However, it is the position of the examiner that such properties are inherent, given that Koch et al as modified by Cisar et al. and

the present application utilize the same perflourosulfonice acid membrane which would posess the same water-filled phase properties. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

Response to Arguments

4. Applicant's arguments filed on September 28th, 2006 have been fully considered but they are not persuasive.

Applicant's principal arguments are

(a) Koch and Cisar taken together do not suggest fuel cells having solid plates between adjacent cells and also transferring water from cathodes to anodes only within the stack, and that neither suggest any way to conduct water from cathodes to anodes except externally of the stack or passing from one cell to an adjacent cell through a non-solid separator.

(b)There are no passageways for conducting coolant water from cathodes to anodes within the fuel cell stack.

(c) There is not even an allegation in the Office Action that a high permeability proton exchange membrane is disclosed in the references.

(d) The gas barrier of Cisar does not extend from one water transport plate of a cell to the other water transport plate of the same cell.

(e) Cisar does not disclose water transfer zones from an edge of one water transport plate of a cell to an edge of the other water transport plate of the same cell.

(f) Claims 10 and 11 require a "microporous water-filled phase in excess of 10 volume %", which paragraph 13 of the Declaration states is not suggested in any of the references.

(g) Cisar discloses no way to conduct water from anv cathode to any anode except through the non-solid gas barrier.

In response to Applicant's arguments, please consider the following comments.

(a), (b), Koch et al. does not specifically teach water transfer means disposed in each of said fuel cells for transferring water only internally within said stack from said cathode

water transport plate to said anode transport plates. However, Cisar et al. disclose an electrochemical cell and bipolar assembly for an electrochemical cell wherein, the bipolar assembly of the present invention comprises a gas barrier and an array of electronically conducting and protruding posts engaged with the gas barrier (Paragraph 0041). Optionally, the gas barrier "passage way" may provide the ability to transfer water between the cathode of one cell and the anode of an adjacent cell while maintaining isolation of the anode and cathode gases. The gas barrier that transfers water can be made from a water permeable material or a composite that includes a water permeable material. Suitable water permeable materials include, but are not limited to, silica, hydrophilic polymers, and cellulose (Paragraph 0045). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the water transfer means of Cisar et al. in to the fuel cell of Koch et al because Cisar et al teach that accordingly, water produced at the cathode, and normally rejected in the exhaust, passes through the barrier where it humidifies the fuel being consumed. This is advantageous because it promotes the full humidification of the PEM membrane, which minimizes its resistance to proton flow (Paragraph 0016).

(c) and (f) Koch et al as modified by Cisar et al. teach that examples of polymers that absorb or conduct moisture include perfluorosulfonic acids (such as Nafion), sulfonated polystyrene, sulfonated trifluorostyrene, polyacrylamides, and similar polymers (Paragraph 0016) (Cisar et al.). The instant specification recites that the

hydrated nanoporous ionomer phase may consist of perflourosulfonic acid ionomer, to achieve a high water permeability PEM which is on the order of between 10 microns and 25 microns thick (Page 5 lines 15-28). Koch et al. as modified by Cisar et al. do not disclose water-filled phase data. However, it is the position of the examiner that such properties are inherent, given that Koch et al as modified by Cisar et al. and the present application utilize the same perflourosulfonice acid membrane which would posess the same water-filled phase properties. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

(d), (e), (g) Cisar et al. disclose an electrochemical cell and bipolar assembly for an electrochemical cell wherein, the bipolar assembly of the present invention comprises a gas barrier and an array of electronically conducting and protruding posts engaged with the gas barrier (Paragraph 0041). Optionally, the gas barrier "passage way" may provide the ability to transfer water between the cathode of one cell and the anode of an adjacent cell while maintaining isolation of the anode and cathode gases (Paragraph 0045).

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben Lewis whose telephone number is 571-272-6481. The examiner can normally be reached on 8:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PATRICK JOSEPH RYAN
SUPERVISORY PATENT EXAMINER

Ben Lewis

Patent Examiner
Art Unit 1745